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1 described in the user manual
2 <http://www.eudora.com/download/eudora/windows/5.2/Manual.zip> on pages 32 to 34.
3 When completing a name or e-mail address in the field such as the "To" field, Eudora not
4 only displays entries from the users address book, but it also searches for matches in a
5 so-called "history file" and displays entries found in there. The Eudora history file
6 consists of names and e-mail addresses of people the user previously sent messages to
7 within Eudora. While to a lesser degree, the same drawbacks as mentioned above apply
8 also here.

9 US patent 6,405,243 describes a network-based method and system for forwarding an
10 email message to an updated email address. After a user changes his or her email address,
11 the user sends information regarding the updated email address to an address-change
12 server used in conjunction with the present invention. The address-change server stores
13 the updated email information in its database. When a sender wants to reach a recipient
14 whose email address has changed, the sender sends an email message to the
15 address-change server. The address-change server forwards the updated email address to
16 the sender. The sender's email program programmatically forwards the sender's email
17 message to the recipient's new email address.

18 From the above it follows that there is still a need in the art for an improved mechanism
19 for offering and completing an address when only portions of a name or address have
20 been entered or are available. This shall lead to more user friendly and effective support
21 systems.

22 SUMMARY OF THE INVENTION

23 In accordance with the present invention, there is provided methods, apparatus and
24 systems executable in a computer system for generating a completion offer and

1 completing an address. A method comprises the steps of detecting an incomplete user
2 input of the address, deriving the completion offer to the incomplete user input in
3 dependence on a derivable score, and offering the derived completion offer for
4 completing the address.

5 The presented method provides a completion of an address when only portions or
6 fractions of a name, address, or phone number have been entered or are available. This
7 allows to design more effective support systems, which help the user to find more quickly
8 addresses that have not been entered in full. The provided support by the method is
9 superior to the known prior art because the completion offers are based on the derivable
10 score. This score approximates the probability or likelihood of the address to be the one
11 intended by the user in the current context of the present invention. The derivable score
12 can be influenced by several factors which can be given but as well as can be chosen or
13 influenced by a user.

14 The completion offer can comprise a list of address completions. The list is ordered in
15 accordance with the derivable score. Moreover, the list of address completions can be
16 presented to the user. Giving the user a list with selectable addresses that has been
17 derived in accordance with the present invention leads to more efficiency as the user finds
18 the desired address more quickly.

19 In fact, two types of completions can be used. First, an automatic completion if one
20 derived completion offer corresponds to the incomplete user input. Then the address is
21 completed immediately without any user interaction. Second, the list of address
22 completions that has been derived in accordance with the present invention is presented
23 to the user, who then can chose the intended address.

24 The step of deriving can comprise determining the completion offer based on a score
25 order. This has the advantage that the way how the score order should be applied can be
26 predefined, e.g. the address having the score with the highest value should be used.

1 When the derivable score is a context dependent address score, then the advantage occurs
2 that the probability is high that an address fragment is completed with the right address.

3 The step of deriving can comprise defining at least one possible address based on the
4 incomplete user input or prior user interactions. This will allow to identify potential
5 address to be offered.

6 Moreover, the step of deriving can further comprise assigning one context dependent
7 address score to the or each possible address, and including the or each possible address
8 in the completion offer in dependence on the or each assigned context dependent address
9 score.

10 A base score can be derived from the content of one or more of a user organizational
11 context record, a user address book, an incoming mail record, an outgoing mail record, an
12 address record, and many other data. As the derivable score bases on the base score, the
13 influence of the base score can be determined and individually set.

14 The context dependent address score can be derived from the base score and from one or
15 more of a user typed address fragment, recently opened addresses, addresses used in
16 recent communication, and recent completion corrections. Several factors or
17 combinations thereof can be used to influence the derivable score. This shows the
18 flexibility of the proposed method and leads to widely applicable scenarios.

19 The base score can decrease over time and thereby influences the derivable score. This
20 supports to adapt or react to changes in the user's behavior of address use. For example,
21 when the user stops sending or using e-mails to a person to whom he sent multiple
22 e-mails before, this will result in a reduction over time of the base score for the address of
23 this person. In other words the mechanism of the address completion takes into account
24 also a time factor for the derivation of the a completion offer.

1 The address referred to herein can be a mail address, an e-mail address, or a phone
2 number. This shows that the proposed method is widely applicable and can be used in
3 text processing systems, e-mail clients, and mobile phones or personal digital assistants
4 (PDAs).

5 In accordance with another aspect of the present invention, there is provided an apparatus
6 for generating a completion offer and completing an address. The apparatus comprises a
7 logic configured to detect an incomplete user input of the address, a logic configured to
8 derive the completion offer to the incomplete user input in dependence on a derivable
9 score, and a logic configured to offer the derived completion offer for completing the
10 address.

11 DESCRIPTION OF THE DRAWINGS

12 Example embodiments of the invention are described in detail below, by way of example
13 only, with reference to the following figures.

14 **FIG. 1** shows a schematic illustration of a data-flow diagram for context
15 dependent address completion.

16 **FIG. 2** shows a schematic illustration of a first event diagram for context
17 dependent address completion.

18 **FIG. 3** shows a schematic illustration of a second event diagram for context
19 dependent address completion.

1 **FIG. 4** shows a schematic illustration of a third event diagram for context
2 dependent address completion.

3 The drawings are provided for illustrative purposes only.

4 DESCRIPTION OF THE INVENTION

5 The present invention provides methods, apparatus and systems executable in a computer
6 system for generating a completion offer and completing an address. In an example
7 embodiment, a method comprises the steps of detecting an incomplete user input of the
8 address, deriving the completion offer to the incomplete user input in dependence on a
9 derivable score, and offering the derived completion offer for completing the address.

10 The presented invention provides a completion of an address when only portions or
11 fractions of a name, address, or phone number have been entered or are available. This
12 allows to design more effective support systems, which help the user to find more quickly
13 addresses that have not been entered in full. The provided support by the method is
14 superior to the known prior art because the completion offers are based on the derivable
15 score. This score approximates the probability or likelihood of the address to be the one
16 intended by the user in the current context of the present invention. The derivable score
17 can be influenced by several factors which can be given but as well as can be chosen or
18 influenced by a user.

19 The completion offer can comprise a list of address completions. The list is ordered in
20 accordance with the derivable score. Moreover, the list of address completions can be
21 presented to the user. Giving the user a list with selectable addresses that has been
22 derived in accordance with the present invention leads to more efficiency as the user finds
23 the desired address more quickly.

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3 completed immediately without any user interaction. Second, the list of address
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5 to the user, who then can chose the intended address.

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7 order. This has the advantage that the way how the score order should be applied can be
8 predefined, e.g. the address having the score with the highest value should be used.

9 When the derivable score is a context dependent address score, then the advantage occurs
10 that the probability is high that an address fragment is completed with the right address.

11 The step of deriving can comprise defining at least one possible address based on the
12 incomplete user input or prior user interactions. This will allow to identify potential
13 address to be offered.

14 Moreover, the step of deriving can further comprise assigning one context dependent
15 address score to the or each possible address, and including the or each possible address
16 in the completion offer in dependence on the or each assigned context dependent address
17 score.

18 A base score can be derived from the content of one or more of a user organizational
19 context record, a user address book, an incoming mail record, an outgoing mail record, an
20 address record, and many other data. As the derivable score bases on the base score, the
21 influence of the base score can be determined and individually set.

22 The context dependent address score can be derived from the base score and from one or
23 more of a user typed address fragment, recently opened addresses, addresses used in
24 recent communication, and recent completion corrections. Several factors or

1 combinations thereof can be used to influence the derivable score. This shows the
2 flexibility of the proposed method and leads to widely applicable scenarios.

3 The base score can decrease over time and thereby influences the derivable score. This
4 supports to adapt or react to changes in the user's behavior of address use. For example,
5 when the user stops sending or using e-mails to a person to whom he sent multiple
6 e-mails before, this will result in a reduction over time of the base score for the address of
7 this person. In other words the mechanism of the address completion takes into account
8 also a time factor for the derivation of the a completion offer.

9 The address referred to herein can be a mail address, an e-mail address, or a phone
10 number. This shows that the proposed method is widely applicable and can be used in
11 text processing systems, e-mail clients, and mobile phones or personal digital assistants
12 (PDAs).

13 In accordance with another aspect of the present invention, there is provided an apparatus
14 for generating a completion offer and completing an address. The apparatus comprises a
15 logic configured to detect an incomplete user input of the address, a logic configured to
16 derive the completion offer to the incomplete user input in dependence on a derivable
17 score, and a logic configured to offer the derived completion offer for completing the
18 address.

19 Although the present invention is applicable to different address and recipient identifiers
20 the focus is put on an e-mail address completion as this is widely desired. At first a
21 general description is given before some details in accordance with the present invention
22 are described with reference to the figures.

23 In general, after each sending or receiving of an e-mail a derivable score, also
24 interpretable as "importance", of the address records of the involved persons is updated
25 by adding "importance points" to their address records. Mails sent to, received from,

1 CCing, or just mentioning a person will result in different increase or addition of points to
2 the scores. In an preferred embodiment, the importance points can decay over time, e.g.
3 points are reduced by a certain percentage each day. The importance measure, i.e. the
4 derivable score, is then used for e-mail address completion. The list of address records
5 sorted by importance is searched sequentially to find matching records. The user can
6 begin to type the e-mail address, name, or first name into one of the address fields of an
7 e-mail. Once a matching record is found the user's typing is completed automatically. On
8 request by the user, in a second step, a full search of the address book is performed, and a
9 list of all potential matches optionally up to a user specified limited number, from the
10 local address book is presented to the user. The list of potential matches is herein also
11 referred to as list of address completions. If the list did not comprises all entries, the user
12 can request a new list with matching addresses. After a local address book has been
13 searched also searches in other remote sources, such as structured sources, e.g. databases,
14 or unstructured sources, e.g. within the Internet, can be performed.

15 In a further embodiment some address records, such as important group aliases, support
16 and help services, and addresses of secretaries, are defined to have "general priority".
17 Such records are always displayed first as long as they match the current string in the
18 address field. These records are also displayed if the user requests a "full search" in an
19 empty address field. Records with "general priority" might be copied from a central
20 address book to the users address book when the user's account is set up and they can be
21 updated through a process that is run on behalf of the user in regular intervals and uses
22 e.g. information about the users position in an organization. Users can modify their
23 "general priority" indicators.

24 If the user wants to find out information about a person, he or she uses the address book
25 and starts searching for the information. The user, also, can just type in an e-mail, a name,
26 or any other information identifying the person into a mail header. On request the full
27 address information can be temporally appended to the mail for reference by the user. The

1 address information will be removed automatically when the mail is sent in accordance
2 with yet another embodiment.

3 Fig. 1 shows a schematic illustration of a data-flow diagram for context dependent
4 address completion where finally a list of address completions is presented to a user. In
5 particular, it is shown which factors or data can influence the derivable score for
6 automatically completing an address. The boxes labeled with 1 to 5 indicate data sources
7 d_i or records of information which are collected, stored, and updated accordingly. An user
8 organizational context database 1, e.g. how a company is structured, a user address book
9 2, an incoming mail record 3, and an outgoing mail record 3, and also further data sources
10 as indicated with blank box 5 can be used to influence a base score that is determinable.
11 As indicated with box 6, here an e-mail address base score is determined based on the
12 input data. The determined base score is stored as an address score, also referred to as
13 $P(\text{Address})$, as shown with box 7. Some details how the base score, i.e. $P(\text{Address})$, can
14 be updated is described in the following.

15 All possible address completions are stored in a list that is updated and sorted by
16 $P(\text{address})$ after each change of the relevant data sources d_i . The data sources d_i can be
17 external data sources.

18 For each data source d_i , a specialized algorithm a_i computes a value for $P_i(\text{address})$.

19 A combination function c computes $P(\text{address})$ by combining all $P_{a-d}(\text{address})$. When d_i
20 changes, only the corresponding $P_i(\text{address})$ is re-computed. The combination function c
21 can then use stored value for the data-sources d_i that have not change.

22 A simple and easy to communicate combination function is the linear combination
23 function cl , which takes the form $P(\text{address}) = \text{Sum}(w(d_i) * P_{a-di}(\text{address}))$, with a weight
24 factor w . The advantage of this combination function is, that the user can control
25 manually the weight of the different data sources d_i .

1 Further, the boxes labeled with 9 to 12 indicate a context dependent datastore or records
2 of information which are also collected and updated accordingly. An user typed address
3 fragment record 9, recently opened addresses or e-mails 10, recent completion corrections
4 12, or addresses used in recent communication, but also further context dependent data
5 sources as indicated with blank box 12 can be used to influence a context dependent
6 address score. The context dependent address score is contemplated as the derivable
7 score. As illustrated with box 13 the context dependent address score is determined from
8 the context dependent records shown in boxes 9 to 12 and the determined base score 7.
9 Some details, how the context dependent address score can be determined, are described
10 in the following.

11 A search is performed for recent manual completions and/or corrections which match
12 with an address request string or incomplete input. If a match is found, this is used to
13 select a completion offer to an incomplete input.

14 Another search is performed searching in the context dependent data sources, such as for
15 example addresses contained in recently opened e-mails 10, for matches with the address
16 request string. A full search is performed, whereby any found matches are proposed. If
17 any current e-mail comprises a body text, or at least a subject line, the text similarity
18 measures between the current message and context text fragments can be used to
19 influence the context dependent address score with which the quality of address
20 suggestions is improved.

21 A sequentially search through a sorted list of possible address completions is performed.
22 When the first two matches are found

23 - the first match is presented to user,

1 - the context dependent address score of the first and second match is compared. If the
2 difference in the score is not large enough, then also the second match is present to the
3 user. The minimum difference in the score can be predefined.

4 - If the second match was presented and not accepted it is continued accordingly with
5 following matches.

6 For efficiency reasons the context dependent address should be re-computed triggered by
7 user context changes. Moreover, the dependent address score can also be determined in
8 regular time intervals.

9 As indicated with box 14, the context dependent address score is used to set up and store
10 a list with addresses with the highest score or probability. The number of address
11 completions to be presented to the user can be defined as indicated with box 15. If the
12 number is 1, then it is apparently clear that the completion of a fragmented address runs
13 automatically without any interaction of the user. However, when the number is set to 2
14 or higher, a list with address completions or completion offers should be presented to the
15 user as indicated with box 16.

16 Fig. 2 shows a schematic illustration of a first event diagram for context dependent
17 address completion. As indicated with box 20, an update of the base score can be
18 triggered when a base score data source 1 to 5 changes its content. For example, the
19 organizational context of the user organizational context database 1 can change, a new
20 address entry in the user address book 2 can be made, or new mails are received/sent
21 which is recorded in the incoming mail record 3 and outgoing mail record 3, respectively.
22 If one or more of the latter happen all P(Address) are updated as indicated with box 22.
23 The update is then finished as shown with box 24.

24 Fig. 3 shows a schematic illustration of a second event diagram for context dependent
25 address completion. As indicated with box 30, the determination of the context dependent

1 address score is triggered by an explicitly or implicitly request of the user for an e-mail
2 address completion. The context dependent address score is then determined as indicated
3 with box 32 and described above. It follows a determination of the number of addresses
4 to be presented as indicated with box 34. As indicated with box 36, one or more
5 completion options, also herein referred to as completion offers, is/are presented to the
6 user. The user can accept or deny. The event diagram ends as shown with box 38.

7 Fig. 4 shows a schematic illustration of a third event diagram for context dependent
8 address completion. The user does not choose any of the completion proposals and
9 manually completes an address string or corrects a completion as indicated with box 40.
10 This triggers the notification of a correction for future computations of context dependent
11 address completion as indicated with box 42. Then, the event diagram ends as indicated
12 with box 44.

13 Any disclosed embodiment may be combined with one or several of the other
14 embodiments shown and/or described. This is also possible for one or more features of
15 the embodiments.

16 Variations described for the present invention can be realized in any combination
17 desirable for each particular application. Thus particular limitations, and/or embodiment
18 enhancements described herein, which may have particular advantages to a particular
19 application need not be used for all applications. Also, not all limitations need be
20 implemented in methods, systems and/or apparatus including one or more concepts of the
21 present invention.

22 The present invention can be realized in hardware, software, or a combination of
23 hardware and software. A visualization tool according to the present invention can be
24 realized in a centralized fashion in one computer system, or in a distributed fashion where
25 different elements are spread across several interconnected computer systems. Any kind

1 of computer system - or other apparatus adapted for carrying out the methods and/or
2 functions described herein - is suitable. A typical combination of hardware and software
3 could be a general purpose computer system with a computer program that, when being
4 loaded and executed, controls the computer system such that it carries out the methods
5 described herein. The present invention can also be embedded in a computer program
6 product, which comprises all the features enabling the implementation of the methods
7 described herein, and which - when loaded in a computer system - is able to carry out
8 these methods.

9 Computer program means or computer program in the present context include any
10 expression, in any language, code or notation, of a set of instructions intended to cause a
11 system having an information processing capability to perform a particular function
12 either directly or after conversion to another language, code or notation, and/or
13 reproduction in a different material form.

14 Thus the invention includes an article of manufacture which comprises a computer usable
15 medium having computer readable program code means embodied therein for causing a
16 function described above. The computer readable program code means in the article of
17 manufacture comprises computer readable program code means for causing a computer to
18 effect the steps of a method of this invention. Similarly, the present invention may be
19 implemented as a computer program product comprising a computer usable medium
20 having computer readable program code means embodied therein for causing a a function
21 described above. The computer readable program code means in the computer program
22 product comprising computer readable program code means for causing a computer to
23 effect one or more functions of this invention. Furthermore, the present invention may be
24 implemented as a program storage device readable by machine, tangibly embodying a
25 program of instructions executable by the machine to perform method steps for causing
26 one or more functions of this invention.

1 It is noted that the foregoing has outlined some of the more pertinent objects and
2 embodiments of the present invention. This invention may be used for many
3 applications. Thus, although the description is made for particular arrangements and
4 methods, the intent and concept of the invention is suitable and applicable to other
5 arrangements and applications. It will be clear to those skilled in the art that
6 modifications to the disclosed embodiments can be effected without departing from the
7 spirit and scope of the invention. The described embodiments ought to be construed to
8 be merely illustrative of some of the more prominent features and applications of the
9 invention. Other beneficial results can be realized by applying the disclosed invention in
10 a different manner or modifying the invention in ways known to those familiar with the
11 art.